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INDEXING OF SCIENTIFIC ARTICLES

By Gordon S. Fulcher
Corning Glass Works, Corning, New York

Including an Analytic Index
of the *Astrophysical Journal*, Vol. 51–54, 1920–1921

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INDEXING OF SCIENTIFIC JOURNALS

By GORDON S. FULCHER

The importance of the service which the subject-indexes of journals may render to scientific research is not generally realized. Yet, in order that the best methods may be chosen and unnecessary duplication avoided, each research should, of course, be based on as complete a knowledge of past results as may be obtained; and the task of guiding the scientist to those parts of the enormous accumulation of scientific literature which relate to his work naturally devolves largely upon the subject-indexes. Also, since the greater the amount of time and effort required by scientists to secure the information needed for effective research, the greater will be the proportion discouraged from attempting it and the greater will be the extent to which the research done will be either less efficient or more delayed than it should be, therefore the responsibility resting upon these indexes, particularly the indexes of abstracting and listing journals, to perform this important task well, is very great.

The question then arises, What characteristics must the indexes have if they are to give the maximum service?

The indexes now provided are of various types and degrees of usefulness. The simplest is a mere *unclassified index of titles*, which are arranged alphabetically by their significant words. The indexes of the *Astrophysical Journal*, the *Physical Review*, and many other journals are of this type.

An improved type is the *classified index of titles* in which the titles are arranged under a limited number of subject headings so as to bring related titles together, the classification being based, however, wholly on the titles. The indexes of *Science Abstracts*, *Journal de Physique*, and others are of this type.

The inadequacy of both these types is obvious for it is well known that in most instances a title cannot sufficiently describe all the subjects treated in the article. A paper on "The Atomic Weight of Iodine" may contain results relating to I_2O_5 and to the occlusion of oxygen by glass; and one on "The Flora of Formosa" may describe new species and perhaps new genera.

A much more serviceable type is the *index of titles classified by content of the articles*, which, while retaining the titles, recognizes their shortcomings and classifies each with more or less precision under headings determined by an examination of the article itself or an abstract. Thus "The Flora of Formosa" would be listed under the genera, species, and other subjects concerning which new information is given. The *International Catalogue of Scientific Literature* and the cumulated indexes of the H. W. Wilson Company—*Agricultural Index, Industrial Arts Index*, etc.—are of this character. The value of this type of index is enhanced if, as in the case of the *Engineering Index* and the card indexes of the Concilium Bibliographicum, the classified titles are supplemented by brief statements as to the contents.

Since, however, most titles are incomplete and many inaccurate, why not disregard them altogether? This is done by the *content index*. In preparing it, the precise subjects dealt with in each article are determined by an analysis of the original or of a reliable abstract, index entries which adequately describe these contents are formulated, and finally these entries are indexed under the proper subject-headings, alphabetically arranged. The index of *Chemical Abstracts* is of this type, being based on an analysis of the abstracts, and is not only one of the largest but also one of the most generally useful indexes now being issued. For the most part, however, the classification is carried through one stage only, with the result that if information on a certain phase of one of the larger subjects is desired, many references may have to be looked up. Moreover, the index depends on abstracts which vary considerably in their standards.

The final step in the development of the subject-index is to base the entries directly—or indirectly through abstracts—on a thorough analysis of the original articles, and to carry the subclassification of the entries through two or three stages so as to make each subdivision complete. Since the articles in the *Astrophysical Journal* for 1920 and 1921 were carefully analyzed in preparing the analytic abstracts[1] which precede the articles, it was possible to prepare

[1] Gordon S. Fulcher, "Scientific abstracting," *Science*, **54**, 291–95, 1921.

from them a very thoroughly classified *analytic index*. This is reprinted at the end of the paper.

To show the characteristics of the analytic index as compared with those of two types of title index, the entries used by each type to index the same four articles, all relating to photography (*Astrophysical Journal*, **52**, 86; **52**, 98; **52**, 201; and **53**, 349), are collected here:

Index of the Astrophysical Journal
(Unclassified Title Index)

Contraction and Distortion on Photographic Plates, Image
Image Contraction and Distortion on Photographic Plates
Images, Mutual Action of Adjacent Photographic
Photographic Images, Mutual Action of Adjacent
Photographic Plates, Image Contraction and Distortion on
Photographic Sharpness and Resolving Power
Photometry and the Purkinje Effect, Photographic
Purkinje effect, Photographic Photometry and the
Resolving Power, Photographic Sharpness and

Index of Science Abstracts
(Classified Title Index)

Photography
Images, Mutual Action of Adjacent Photographic[1]
Photometry, Photographic, and Purkinje-Effect
Plates, Photographic, Image Contraction and Distortion on
Resolving Power, Photographic Sharpness and[1]
Vision
Purkinje-effect, and Photographic Photometry

Analytic Index[2]

Photographic plates; properties
contrast functions
drying, time of
grain size
images
contraction and distortion
mutual action
sections

[1] These references are put in by analogy with the others, as the 1921 index has not yet been issued.

[2] Headings and subheadings alone are given; see the complete index herewith reprinted for details.

intensification
penetration of light
resolving power
sharpness
shifts of spectrum lines and star images
theoretical relations
turbidity
Photometry, photographic, heterochromatic
Purkinje effect, photographic
Spectra
measurements
errors possible
shifts of lines
photographic
Stars
measurements from photographs
errors possible
Sun
spectrum
shifts of lines
photographic

The precision and completeness of the analytic index as compared with the title indexes is evident. Moreover, since all the results relating to each subject are indexed together, the analytic index also provides a summary, in outline, of the work done in each field; that is, the reader interested in a particular subject, such as clusters, nebulae, spectra, variables, can determine in what phases of the subject progress has been made by consulting the proper sections of the index. On the other hand, the danger of indexing by titles alone is illustrated by the classification, in the *Index of Science Abstracts*, of the reference to the photographic Purkinje effect under "Vision" whereas the article contains, in fact, no reference to the eye, the indexer being misled by the title.

It may be objected that, while the analytic and other good content indexes are clearly more useful than any title indexes, they are too long and too difficult and laborious to prepare. But a comparison of the analytic index, here reprinted, with the corresponding four separate volume indexes of the *Astrophysical Journal* shows that the analytic index has only twice as many words as the

unclassified title indexes, though containing three times as many references, which are, moreover, precisely and thoroughly classified. Also, the preparation does not require remarkable ability nor should it take an undue amount of the editor's time if the work is well organized. After deciding as to the classification to be adopted, the editor's task is merely to indicate on the abstracts the titles to be used to index the articles (heads and subheads being designated in some convenient way) and later to go carefully through the entries which have been typewritten on slips and arranged alphabetically. The clerical work can be greatly simplified by the use of methods developed by such indexing agencies as *Chemical Abstracts*, the H. W. Wilson Company, and the *New York Times*.

The subject-indexes now serving the various sciences vary widely in type and usefulness, as stated above. Some are very poor, some very good; but none is as complete and precise as it should be if it is to give maximum service to research in its field. It is only a question of time, however, when the workers in each science will come to realize the incalculable value of an efficient abstract journal combined with a complete, precise, and thoroughly classified subject-index, and they will arrange to make the small sacrifices of time and money necessary to secure such uniquely important tools.

ANALYTIC INDEX OF *ASTROPHYSICAL JOURNAL* FOR 1920 AND 1921, VOLUMES 51–54, BASED ON THE ANALYTIC ABSTRACTS

For references to spectra and spectroscopy of elements and compounds *see* Spectra.

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